Internet-based Heat Evaluation and Assessment Tool (I-HEAT) Feasibility Study

Health and Air Quality Applications Program Review

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I-Heat Project Team

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Why Heat?

- Heat is the leading weather-related cause of death

- Identifiable vulnerable populations – both individual and community characteristics

- Adverse health outcomes are preventable

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Project Overview

Provide health professionals with an advanced geospatial web-based system for preparing and responding to emergency heat events, developing mitigation strategies, and educating the public.

The system will couple demographic and environmental data obtained from Landsat satellite imagery with browser-based software to model and map heat-related morbidity and mortality risks at the neighborhood level.

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Demographic Data

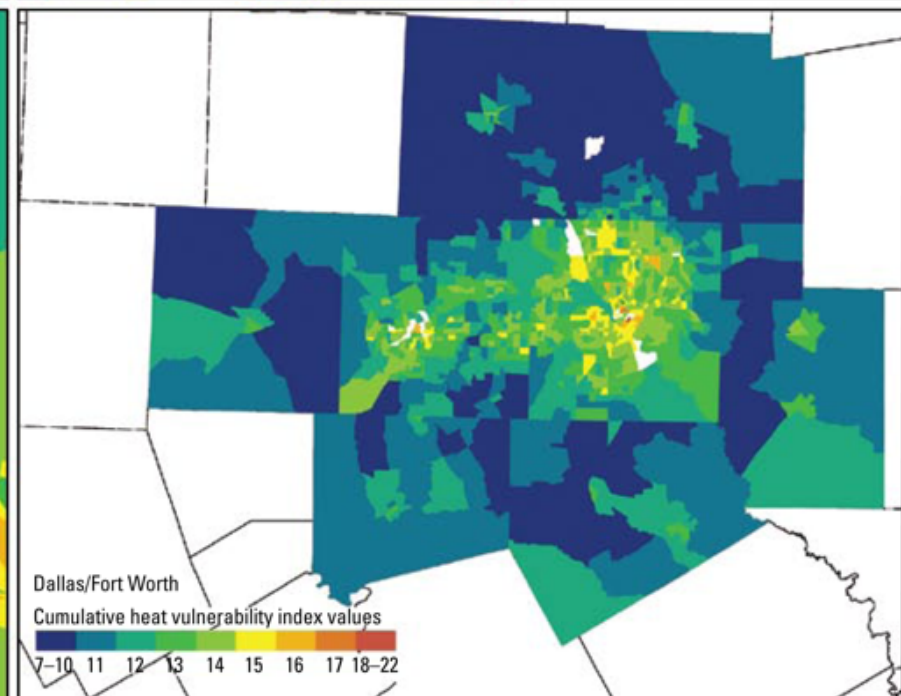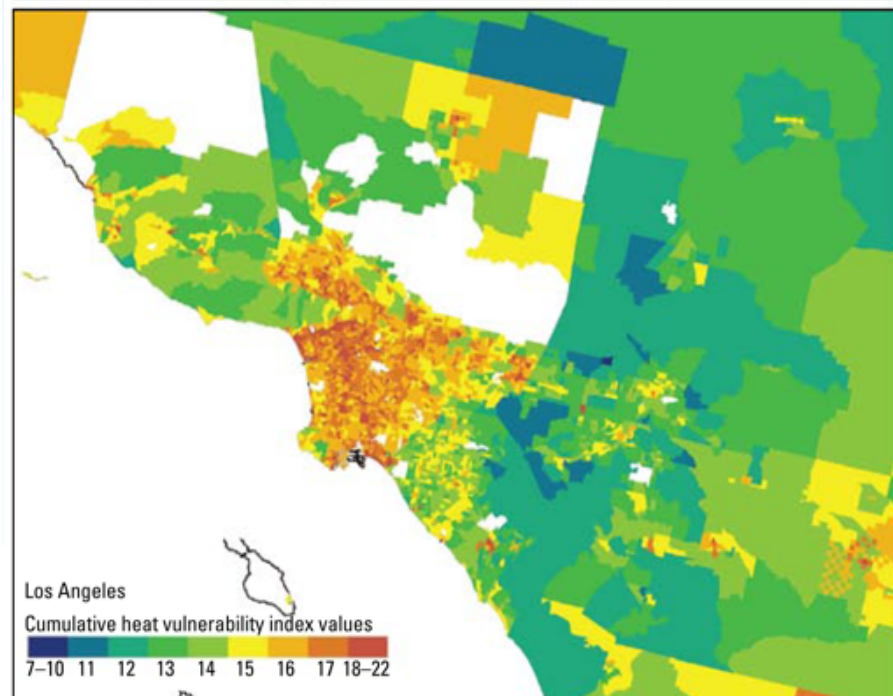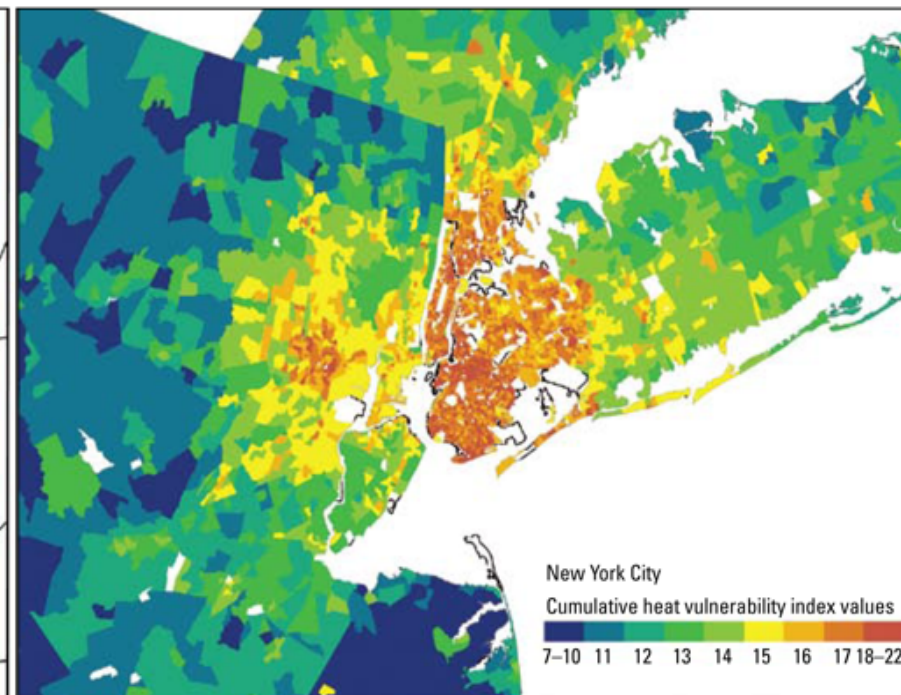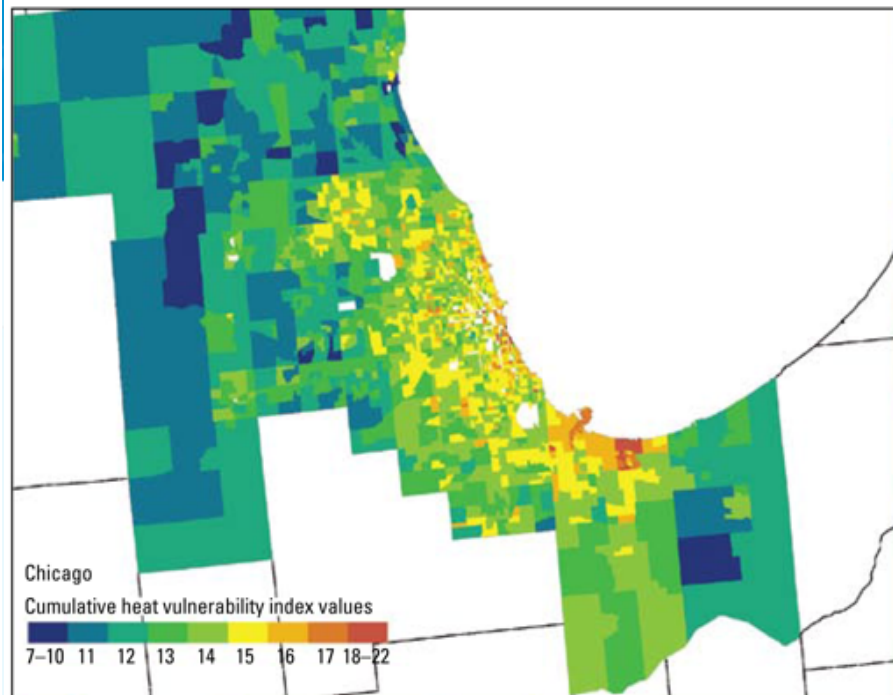| Category	Data Source (year)	Variable Definition
Demographic variables	US Census (2000)	Percent population below the poverty line
		Percent population with < HS diploma
		Percent populaiton, non-white
		Percent population living alone
		Percent population ≥ 65 years
		Percent population ≥ 65 years, living alone
Land cover	National Land Cover Database (2001)	Percent census tract area not covered in vegetation
Diabetes prevalence	Behavioral Risk Factor Surveillance System (2002)	Percent population ever diagnosed with diabetes
Air conditioning	American Housing Survey (2002)	Percent households without any central AC
		Percent households without any AC

*adapted from Reid et al., 2009

Heat Vulnerability Index

- Place-based
- Populations not equally vulnerable to effects of heat
- Successful interventions need to know **where** to find vulnerable populations

Computed Factor	Description
Factor 1	Social/Environmental Vulnerability
Factor 2	Social Isolation
Factor 3	Lack of AC
Factor 4	High Proportion of Elderly with Diabetes

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Chicago
Cumulative heat vulnerability index values

7–10 11 12 13 14 15 16 17 18–22

New York City
Cumulative heat vulnerability index values

7–10 11 12 13 14 15 16 17 18–22

Los Angeles
Cumulative heat vulnerability index values

7–10 11 12 13 14 15 16 17 18–22

Dallas/Fort Worth
Cumulative heat vulnerability index values

7–10 11 12 13 14 15 16 17 18–22

Environmental Data

- Temperature and NDVI satellite data

- Originally planned to use WELD satellite data, but gaps led to a switch to Landsat 5 data

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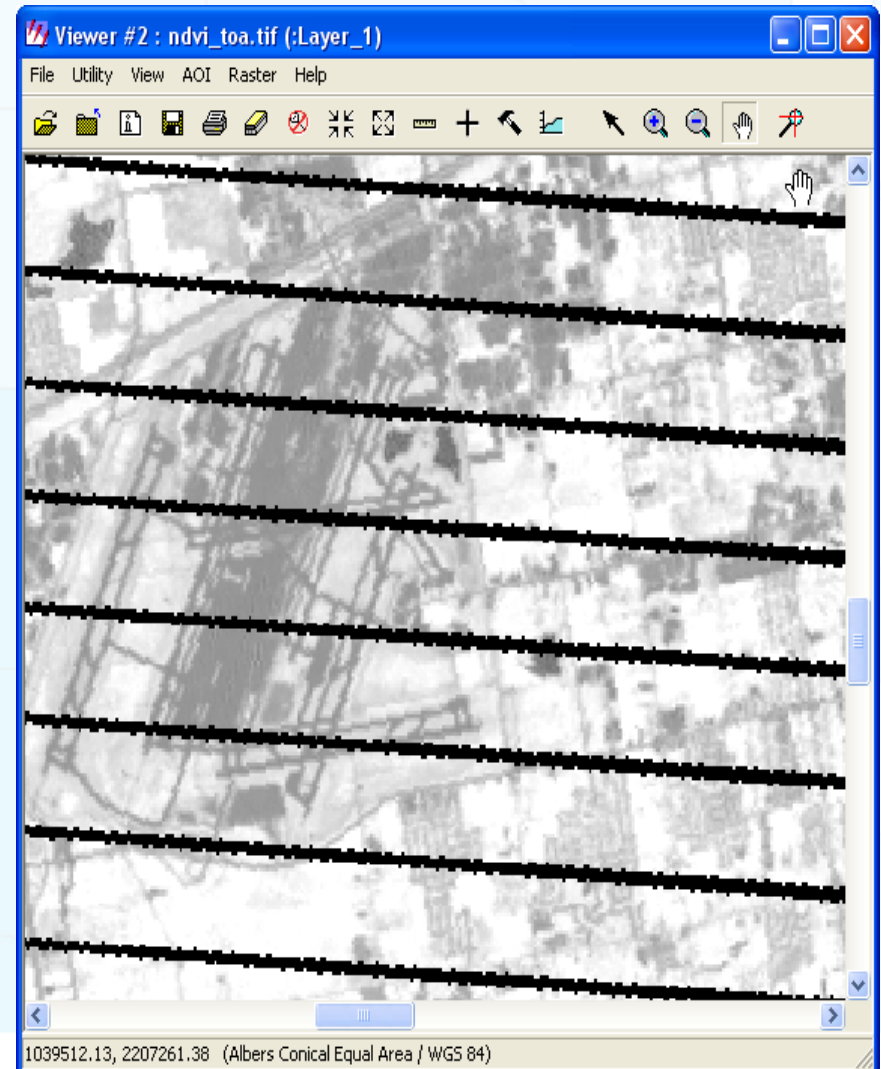
"At-risk" Calculation
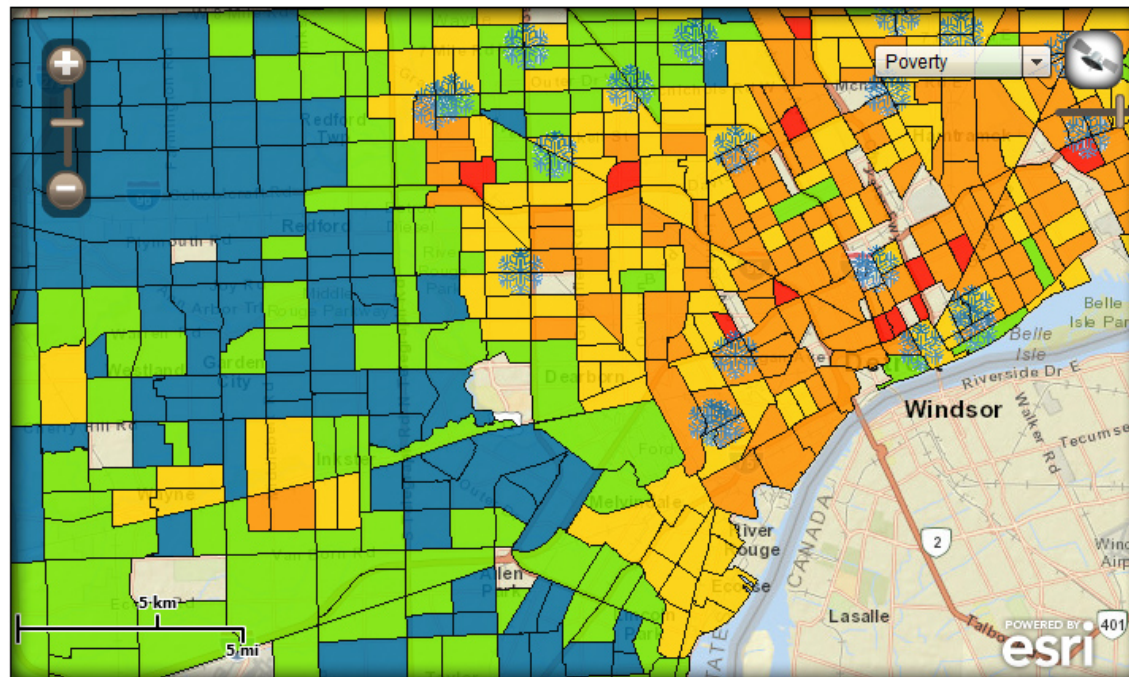
- Allows the end user to choose the relative importance of environmental conditions versus vulnerability

- R = f(D,E)

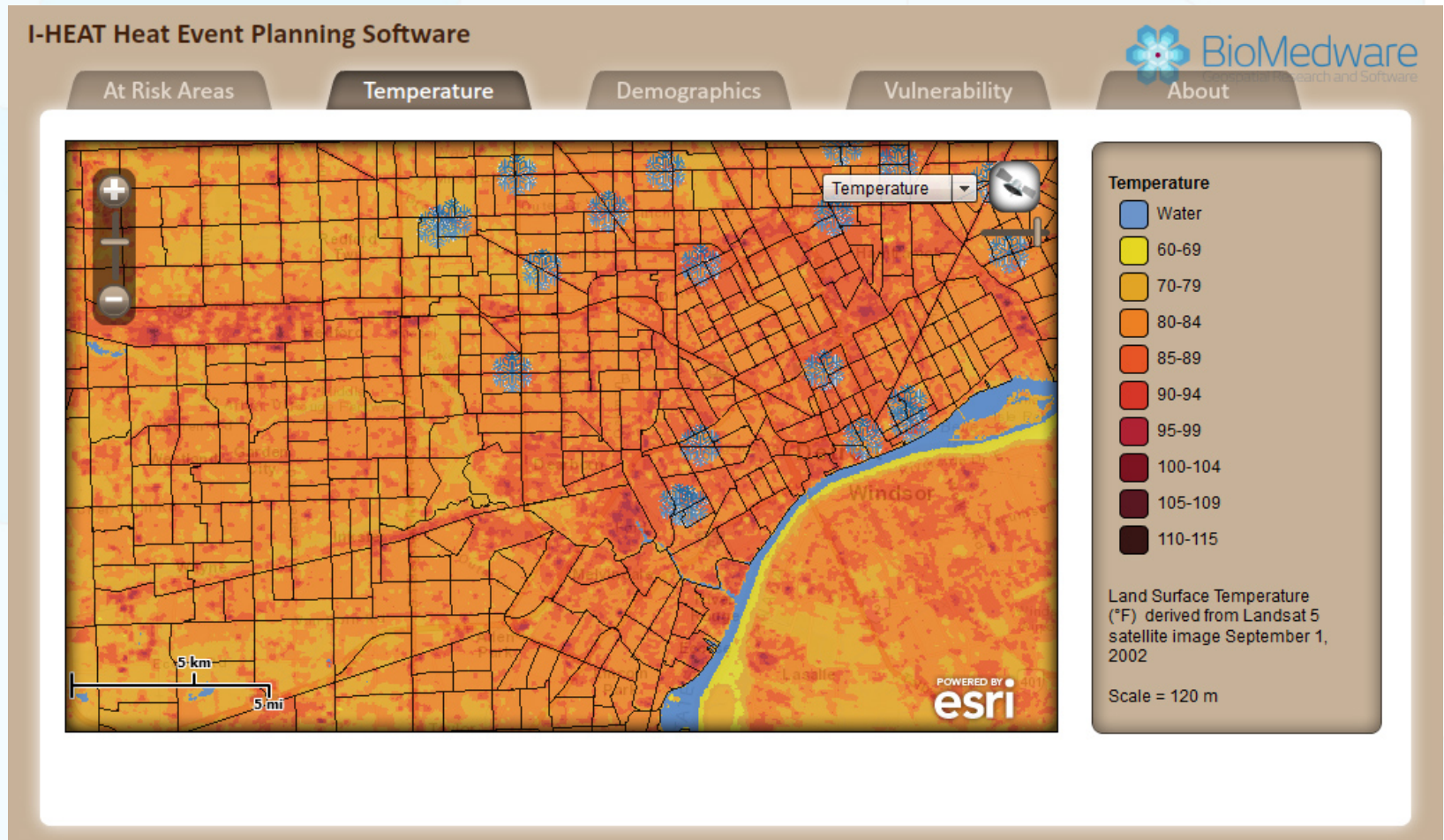 (D = demographic, E = environmental)

- R = (x)(T) + (1-x)*HVI

  T = mean, standardized temperature;

  HVI = vulnerability index;

  x = relative weight

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I-Heat Software

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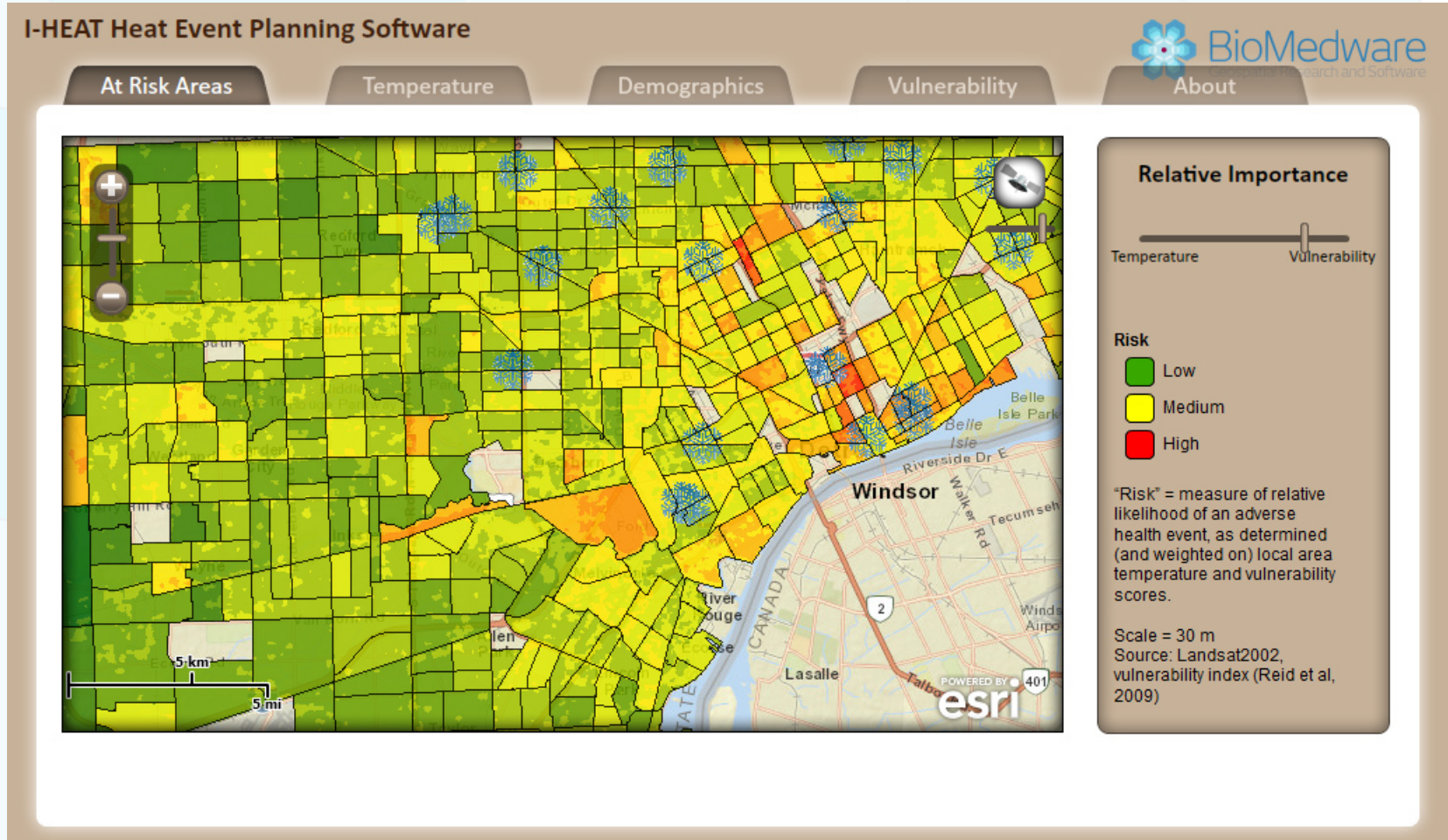
User Workshop

"Heat & Health in Michigan: An Interactive Workshop on the Development of Risk Assessment Resources" May 2, 2012

- Organized with Michigan academic and government partners
- Participants:
  - State agencies
  - Local health departments
  - Emergency preparedness agencies
  - Academic institutions
  - Community-based, non-profit organizations
- 12-Question survey
- Semi-structured focus group

Workshop Recommendations

- Improvements needed on:
  - Performance
  - Terminology
    - "At-risk"
    - "Vulnerability"
  - Data updates
    - Heat vulnerability index
    - Temperature
  - Local inputs
  - Explicit mitigation/adaptation potentials

- Some of the recommendations were implemented post-workshops. Others can be implemented in a release-version of the software.

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Project Deliverables

- I-HEAT software system
  - Detroit, Michigan pilot study (Completed)
  - Integration of WELD/Landsat (temperature and vegetation) and demographic/socio-economic/health that enables identification of at-risk populations (Completed)
- I-HEAT end-user evaluation
  - User survey (Completed)
  - Comparison to CDC study (baseline) (completed)
- Feasibility Assessment Report (in progress)
  - Include: system configuration, quantitative and qualitative enhancements to decision support activity, major problems encountered/resolved, lessons learned, recommendations, remaining issues for sustained use of WELD/Landsat in the decision-making activity
- Presentations/publications/reports (in progress)
- Data, maps, and publications on BMW website (Completed)

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Dissemination

- Heat & Health in Michigan Workshop (May 2012)

- Presentations at:
  - Presented at ESRI Campus (Dec 2011)
  - Population Health Data Analysis Conference (Feb 2012)
  - International Society for Environmental Epidemiology (Aug 2012)
  - CDC Science Symposium on Climate and Health (Sep 2012)

- Upcoming publication

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From Feasibility to Implementation

- Update/expand vulnerability index and data layers

- Combine regular remotely-sensed, high spatial resolution heat/NDVI with ground-measured temperature to generate real-time heat maps

- Expand coverage beyond Detroit area

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